



# **LAKE CLASSIFICATION SHORT REPORT FOR ARKDALE LAKE, ADAMS COUNTY**

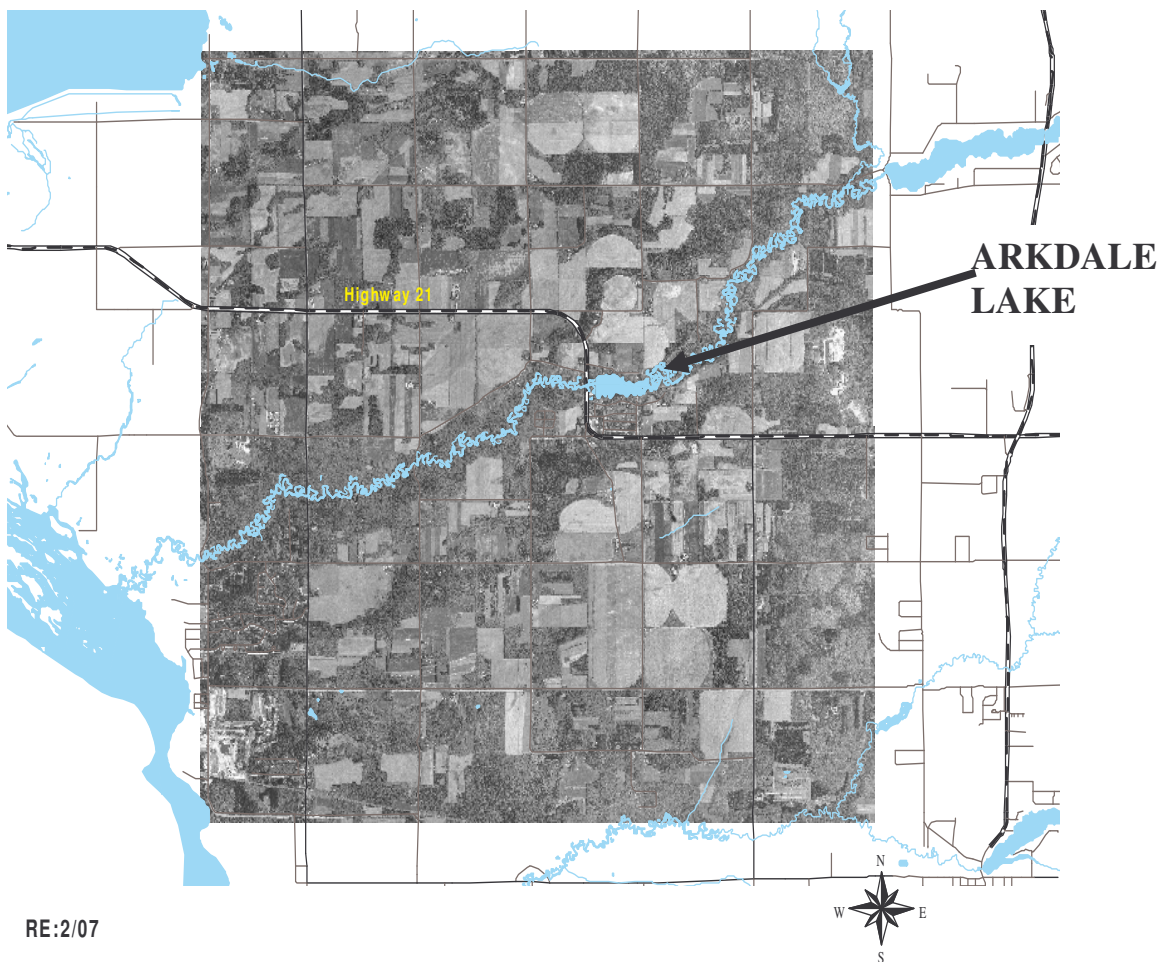
**Presented by Reesa Evans, Lake Specialist  
Adams County Land & Water Conservation Department  
P.O. Box 287, Friendship, WI 53934**

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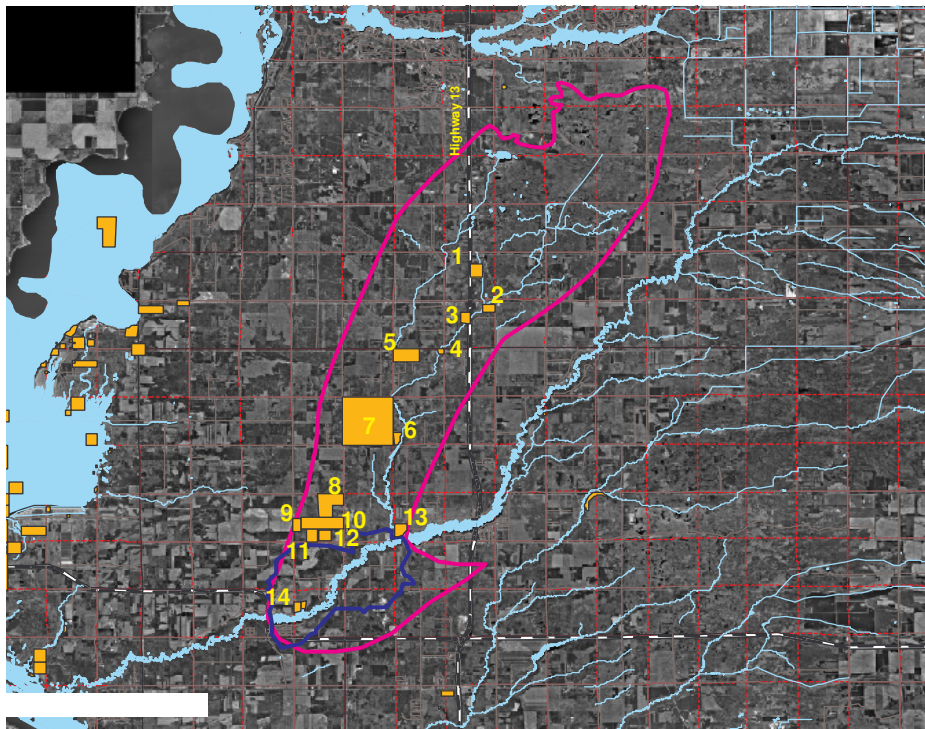
Photo courtesy of Doug Wellumson

# Introduction

**Information about Arkdale Lake:** Arkdale Lake is located in the Town of Strongs Prairie, Adams County, WI (T18N, R5E, S15), in the south central part of Wisconsin. It is reached off of Highway 21. Arkdale Lake is a mesotrophic/mildly eutrophic impoundment with fair to good water quality and fair water clarity. It has 56 surface acres, with a maximum depth of 8 feet and an average depth of less than 5 feet. A dam owned by the Arkdale Lake Association controls the water level in the lake. The lake has a history of dense aquatic vegetation throughout the lake and increasingly shallow depths. There are two public boat ramps, one on the south side of the lake and one on the north side of the lake.



# Arkdale Archeological Sites



\*information from Wisconsin Burial Society



RE:4/05; revised 7/06



There are many Native American archeological sites in Adams County, with several in the Arkdale watersheds, as shown on the map above. In order to preserve Native American heritage, federal and state laws prohibit further disturbance of these sites without permission of the government and input from the local tribes.

Conical mound



# Land Use

The surface watershed for Arkdale Lake is fairly small, but Arkdale Lake has a very large ground watershed. Studies have shown that lakes are the products of their watersheds. Land use especially can affect amount and content of stormwater runoff. Runoff volume is affected by the amount of impervious surface, the soil type and the slope of the area in the surface watershed. Natural landscapes tend to have low stormwater runoff rates.

Land use in both the surface and ground watersheds are shown on the chart below:

	<b>Surface</b>		<b>Ground</b>		<b>Total</b>	
<b>Arkdale Lake</b>	<b>Acres</b>	<b>% of Total</b>	<b>Acres</b>	<b>% of Total</b>	<b>Acres</b>	<b>% of Total</b>
Agriculture--Non Irrigated	841.87	30.77%	931.14	4.53%	1773.01	7.61%
Agriculture--Irrigated	288.1	10.53%	370	1.80%	658.1	2.83%
Government	88.65	3.24%	160.33	0.78%	248.98	1.07%
Grassland/Pasture	0	0.00%	631.04	3.07%	631.04	2.71%
Residential	332.15	12.14%	2861.26	13.92%	3193.41	13.71%
Water	288.1	10.53%	1050.36	5.11%	1338.46	5.75%
Woodland	897.13	32.79%	14,550.88	70.79%	15448.01	66.32%
total	2736	100.00%	20,555	100.00%	23291	100.00%

Slightly over 40% of the surface watershed for Arkdale Lake is agriculture (irrigated and non-irrigated). Traditionally, agriculture may contribute significant amounts of nutrients. The next largest land use in the surface watershed is woodlands. These cover 33% of the surface water acreage. Since forest floors are often full of leaves, needles and other duff, runoff from forested lands is usually lower in volume and more filtered than runoff from agricultural or residential lands.

Residential areas may also be significant contributors to stormwater runoff and related nutrient loading. This is the third largest land use in the surface watershed. This land use category may also contribute nutrients to the water from stormwater runoff, mowed lawns and impervious surfaces. This nutrient source should also be reduced as much as possible. Other potential nutrient sources for water include human and animal wastes, failing septic systems, ground watershed and stormwater runoff from other land uses.

There are also several wetlands in the Arkdale Lake watersheds, including a large wetland area on the northeast end of the lake. Wetlands play an important role in water quality by trapping many pollutants in runoff waters and by serving as buffers to catch and control what would otherwise be uncontrolled water and pollutants. Wetlands also play an essential role in the aquatic food chain, thus affecting fishery, and also serve as spaces for wildlife habitat, reproduction, nesting, and wildlife food. It is essential to preserve these wetlands for the continued health of Arkdale Lake waters.

## Looking towards wetlands on northeast end of Arkdale Lake

Photo courtesy of Doug Wellumson



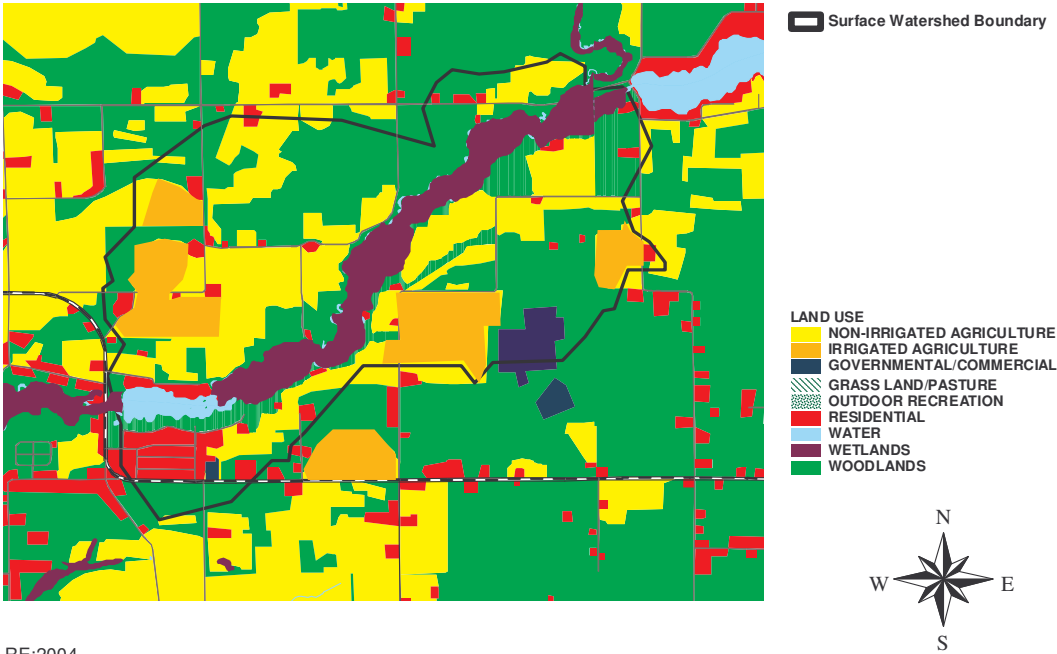
Like many lakes in Wisconsin, Arkdale Lake is a phosphorus-limited lake, meaning that of the pollutants that end up in the lake, the one in the shortest supply that most affects the overall quality of the lake water is phosphorus. Land use types play a major role in determining the amount of phosphorus being loaded into the lake.

Recent computer modeling suggests that the single biggest contributor of phosphorus to the Arkdale Lake surface watershed is the extended Big Roche a Cri watershed, which accounts for about 68% of the nutrient loading in Arkdale Lake. Other ground watershed areas account for nearly another 20% of nutrient loading.

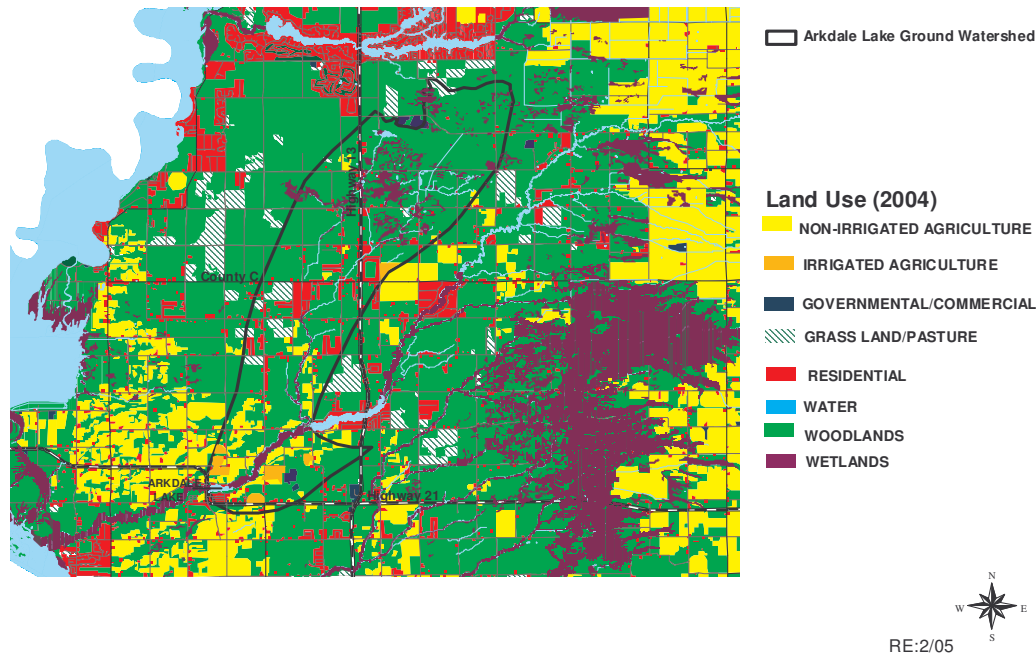
Some aspects of phosphorus loading can't be modified by human behavior—they are simply part of the natural landscape. However, phosphorus loading from agriculture, residential and septic use of the land can be decreased or increased by human activity. A reduction of only 10% in those areas would result in 691.17 **fewer** pounds per year of phosphorus—and considering that one pound of phosphorus can produce up to 500 pounds of algae...that could mean up to 345,585 **fewer** pounds of algae per year of the lake!

	<b>Current</b>	-10%	-25%	-50%
	<b>lbs/yr</b>	<b>lbs/yr</b>	<b>lbs/yr</b>	<b>lbs/yr</b>
<b>Phosphorus Loading</b>				
Agriculture--Non Irrigated	299.2	269.28	224.4	149.6
Agriculture--Irrigated	127.6	114.84	95.7	63.8
Government	4.4	4.4	4.4	4.4
Residential	37.4	33.66	28.05	18.7
Lake (atmosphere deposition)	6.6	6.6	6.6	6.6
Other Water	30.8	30.8	30.6	30.6
Woodland	39.6	39.6	39.6	39.6
groundshed	915.2	823.68	686.4	457.6
septic	14.52	13.068	10.89	7.26
upstream watershed (BRC)	3212.44	2891.196	2409.33	1606.22
total in pounds/year	4687.76	4227.124	3535.97	2384.38

# Land Use--Arkdale Lake Surface Watershed



## ARKDALE LAKE GROUND WATERSHED--LAND USE



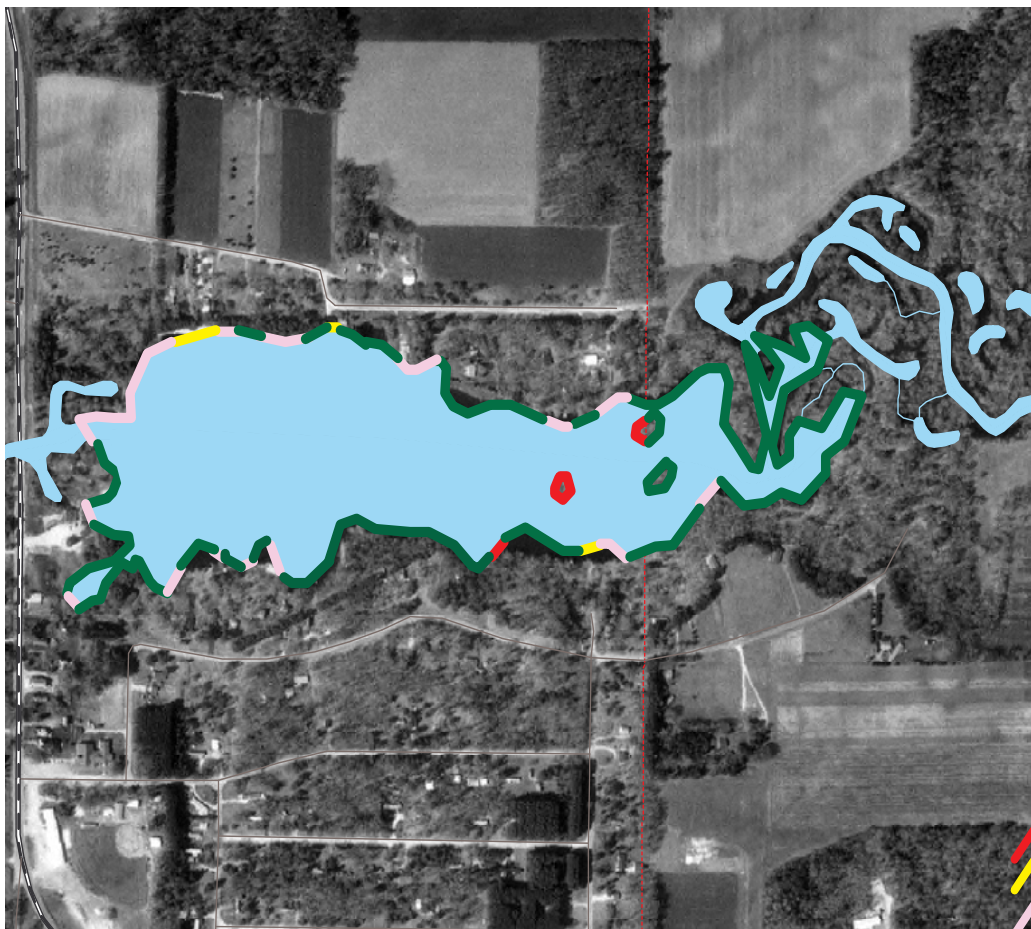


Arkdale Lake has a total shoreline of 4.1 miles (21,648 feet). This includes several channels at the northeast end of the lake that wind in and out of a bog and a sedge meadow.

The rest of the lakeshore is in residential use. While of the areas on the south shore are steeply sloped, the land is flatter on the north, west and east sides.

Over half of Arkdale Lake's shoreline is vegetated. However; a 2004 shore survey showed that only 32.0% of the main lake body had an "adequate buffer," which is defined as a native vegetation strip at least 35 feet landward from the shore.

## Shoreline of Arkdale Lake



-  Active Erosion
-  Sand or Gravel
-  Rocks, Seawall, Hard Structure
-  Vegetated Shore

RE:2/05



Most of the “inadequate” buffer areas were those with traditional mowed lawns, rock riprap and insufficient native vegetation at the shoreline to cover 35 feet landward from the water line. Heavy erosion was noticed on the island shorelines at the east end of the lake.

## Buffers on Arkdale Lake



RE:2/05



Adequate Buffer



Inadequate Buffer





Shoreland buffers are an important part of lake protection and restoration. These buffers are simply a wide border of native plants, grasses, shrubs and trees that filter and trap soil & similar sediments, fertilizer, grass clippings, stormwater runoff and other potential pollutants, keeping them out of the lake. A 1990 study by the Wisconsin Department of Natural Resources of Wisconsin shorelines revealed that a buffer of native vegetation traps 5 to 18 times more volume of potential pollutants than does a developed, traditional lawn or hard-armored shore. The filtering process and bank stabilization that buffers provide help improve a lake's water quality, including water clarity.



**Example of Adequate Buffer**



**Example of Inadequate Buffer**

Vegetated shoreland buffers help stabilize shoreline banks, thus reducing bank erosion. The plant roots give structure to the bank and also increase water infiltration and decrease runoff. A vegetated shore is especially important when shores are steep and soft, as are several of the Arkdale Lake shores.

# Water Quality Information

One of the measures Wisconsin uses to give a general estimate of a lake's water quality is the **trophic state index**. This index looks at a lake's water clarity, its amount of total phosphorus (the element most related to aquatic plant and algal growth), and its chlorophyll-a level (chlorophyll-a is a pigment used by algae for photosynthesis).

Depending on the trophic index score, lakes are then classified as **Oligotrophic** (good), **Mesotrophic** (fair), or **Eutrophic** (poor):

- **Good:** Oligotrophic lakes have clear, deep water with few algal blooms. Larger game fish are often found in such lakes.
- **Fair:** Mesotrophic lakes have more aquatic plant and algae production, with occasional algal blooms and a good fishery. The water is usually not as clear as that of oligotrophic lakes.
- **Poor:** Eutrophic lakes are very productive, with lots of aquatic plants and algae. Algal blooms are often frequent in these lakes. They may have a diverse fishery, but rough fish (such as carp) are also common. Water is often cloudy or murky. Small shallow lakes are more likely to be eutrophic.

Score	TSI Level Description
30-40	<b>Oligotrophic:</b> clear, deep water; possible oxygen depletion in lower depths; few aquatic plants or algal blooms; low in nutrients; large game fish usual fishery
40-50	<b>Mesotrophic:</b> moderately clear water; mixed fishery, esp. panfish; moderate aquatic plant growth and occasional algal blooms; may have low oxygen levels near bottom in summer
50-60	<b>Mildly Eutrophic:</b> decreased water clarity; anoxic near bottom; may have heavy algal bloom and plant growth; high in nutrients; shallow eutrophic lakes may have winterkill of fish; rough fish common
60-70	<b>Eutrophic:</b> dominated by blue-green algae; algae scums common; prolific aquatic plant growth; high nutrient levels; rough fish common; susceptible to oxygen depletion and winter fishkill
70-80	<b>Hypereutrophic:</b> heavy algal blooms through most of summer; dense aquatic plant growth; poor water clarity; high nutrient levels

**Arkdale Lake's overall TSI is 52**



Water clarity readings are usually taken by using a Secchi disk (shown at right). **Average summer Secchi disk clarity in Arkdale Lake in 2004-2006 was 5.17 feet**, in the “fair” category. Records since 1994 show that the water in Arkdale Lake has remained in this clarity category. Water clarity can be reduced by turbidity (suspended materials such as algae and silt) and dissolved organic chemicals that color or cloud the water.

Increased phosphorus levels in a lake will feed algal blooms and also may cause excess plant growth. **The 2004-2006 summer average phosphorus concentration in Arkdale Lake was 29.5 micrograms/liter.** This is just below the recommended 30 micrograms/liter average for impoundments in Wisconsin to avoid frequent algal blooms and puts Arkdale Lake in the “fair” category for phosphorus levels. Phosphorus levels should continue to be monitored.



The third measure used in trophic state classification is the amount of chlorophyll-a contained in the lake. The amount of chlorophyll-a found in a lake is an indication about the amount of algae in the lake. **The 2004-2006 summer average chlorophyll-a concentration in Arkdale Lake was 7.5 micrograms/liter.** This low level of chlorophyll-a gives Arkdale Lake a “good” ranking for chlorophyll-a.



# In-Lake Habitat

## Aquatic Plants

A diverse aquatic plant community plays a vital role in improving water quality, providing valuable habitat resources for fish and wildlife, resisting invasions of non-native species and checking excessive growth of the most tolerant species.

An aquatic plant survey was performed in 2005. The 1.5'-5' depth zone supported the most abundant aquatic plant growth, although the 0-1.5' depth zone was close behind. The Arkdale Lake aquatic plant community is characterized by abundant filamentous algae and plants that tolerate a high amount of disturbance. *Potamogeton zosteriformis* (flat-stemmed pondweed), *Vallisneria americana* (water celery), and *Arkdalefia columbiana* (watermeal) were the most common aquatic species.

Important to maintaining a quality, diverse aquatic plant community is an integrated aquatic plant management plan that controls the invasive plants in the lake. The most prevalent invasive exotic in Arkdale Lake is currently *Myriophyllum spicatum* (Eurasian watermilfoil), which occurred in all three depth zones, with an overall frequency of about 10%. No other invasive plants found in the 2005 survey, but since this survey was done in August, Curly-Leaf Pondweed (*Potamogeton crispus*), which is known to be in the lake, was probably already gone for the season.



**Curly-Leaf Pondweed**



**Purple Loosestrife**

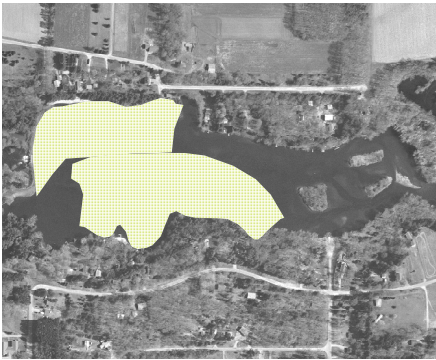


**Eurasian Watermilfoil**

More detailed information can be found in the aquatic plant report of the 2005 survey, available on request from the WDNR or Adams County Land & Water Conservation Department.



### Distribution of Eurasian Watermilfoil in 2005



Eurasian  
Watermilfoil Found



RE:12/05

### Emergent Plants in Arkdale Lake

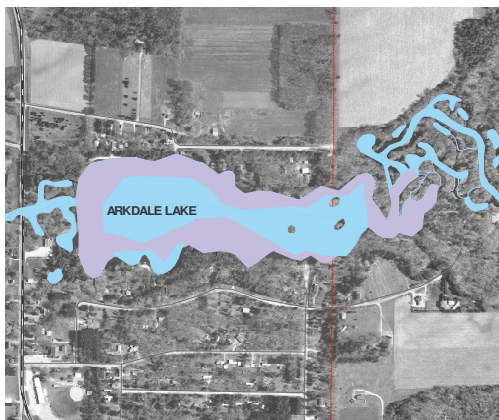


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Emergent Plants Found



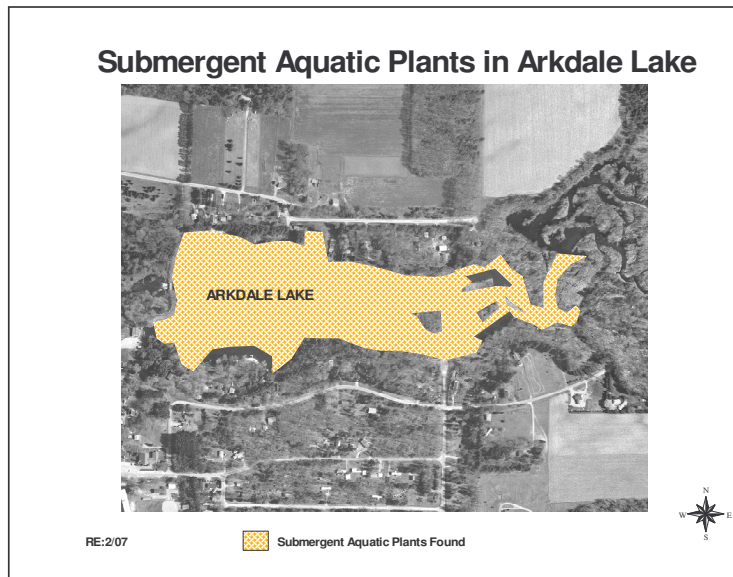
### Free-Floating & Floating-Leaf Plants in Arkdale Lake



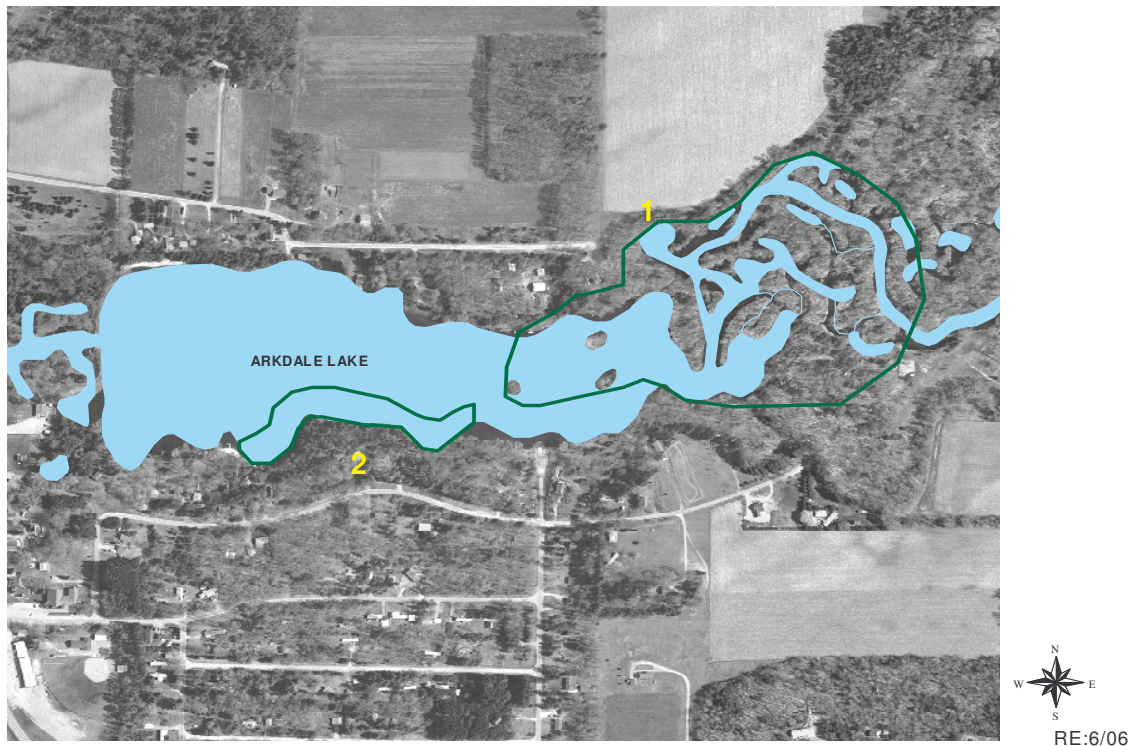
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Free-Floating or Floating-Leaf  
Plants Found



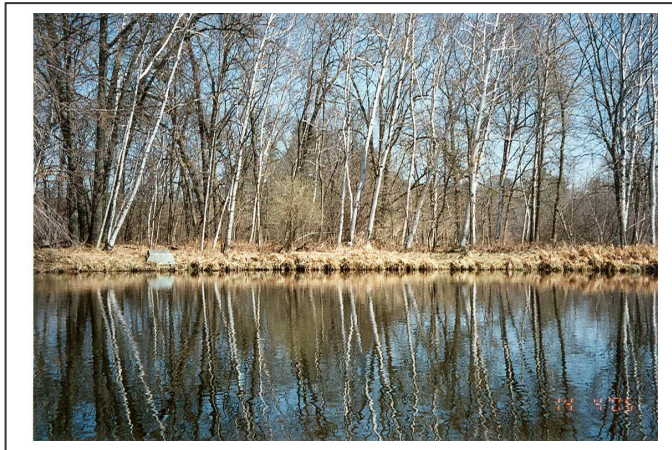


## Critical Habitat Areas--Ardale Lake



Wisconsin Rule 107.05(3)(i)(I) defines a “critical habitat areas” as: “areas of aquatic vegetation identified by the department as offering critical or unique fish & wildlife habitat or offering water quality or erosion control benefits to the body of water. Thus, these sites are essential to support the wildlife and fish communities. They also provide mechanisms for protecting water quality within the lake, often containing high-quality plant beds. Finally, critical habitat areas often can provide the peace, serenity and beauty that draw many people to lakes in the first place.

Two areas on Arkdale Lake were determined to be appropriate for critical habitat designation. AR1 extends along the northeast end of the lake and the eastern end of the north shore, up to the ordinary high water mark. This area includes marsh and wetland. AR2 extends along about 425' of the southern shoreline.



**Part of AR1**



**Part of AR2**

The Critical Habitat Report for Arkdale Lake has more specific information on these sites. Copies are available from the Adams County Land & Water Conservation Department.

## **Fishery/Wildlife/Endangered Resources**

WDNR fish stocking records for Arkdale Lake go back to 1935, when northern pike, bullheads and bass were put into the lake. In 1965, a break of the Arkdale Dam resulted in several hundred dead fish. An evaluation in 1971 determined that the lake was best suited for northern pike, largemouth bass and panfish. A 1995 WDNR survey of Arkdale Lake indicated that northern pike and white sucker were abundant. Yellow perch, black crappie and bluegills were common, but largemouth bass, walleye, spotted suck and pumpkinseed were scarce. Recent reports from lake users express the belief the fishing has declined since the infestation by rusty crayfish. Aquatic plant growth at the eastern end of the lake has declined since that infestation as well. A plan for diminishing the impact of rusty crayfish needs to be developed by the Arkdale Lake Association.



Seen during the field survey were various types of waterfowl and songbirds. Frogs and salamanders are known, using the lakeshore for shelter/cover, nesting and feeding. Turtles and snakes also use this area for cover or shelter in this area, as well as nested and fed in this area. Upland wildlife feed and nest here as well.

The Arkdale Lake watersheds are home to many endangered resources. Endangered natural communities found in these watersheds include floodplain forest, lake (shallow, hard, seepage), northern sedge meadow, northern wet forest, pine barrens and shrub-carr. Endangered, threatened or special concern plant species found in these watersheds are Crossleaf Milkwort, Engelmann Spikerush, Grassleaf Rush, One-Flowered Broomrape, Slim-stem Small-reedgrass, Whip Nutrush and Yellow Screwstem. Karner Blue Butterfly, Persius Dusky Wing Butterfly and Sand Snaketail Dragonfly, all either endangered, threatened or of special concern, are also present in these watersheds.



**Whip Nutrush**

**Karner Blue Butterfly**





# Recommendations

## **Lake Management Plan**

- By the end of 2008, if not sooner, Arkdale Lake Association should develop a lake management plan. The Adams County Land & Water Conservation Department is available for assistance, if requested.
- The lake management plan needs to include at least the following aspects concerning the management of the lake: aquatic species management; control/management of invasive species; wildlife and fishery management; nutrient budgeting; shoreland protection; critical habitat protection; water quality protection. The plan should specifically address reducing the population & impact of the Rusty Crayfish infestation.

## **Watershed Recommendations**

- Since computer modeling results suggest that input of nutrients, especially phosphorus, are a factor that needs to be explored for Arkdale Lake, it is recommended that both the surface and ground watersheds be inventoried, documenting any of the following: runoff from any livestock operations that may be entering the surface water; soil erosion sites; agricultural producers not complying with nutrient management plans and/or irrigation water management plans. This inventory must include the Big Roche a Cri Creek watershed northeast of Arkdale Lake.
- If such sites are documented, the Arkdale Lake Association should encourage landowners & the Adams County Land & Water Conservation Department to design and implement practices to address identified site issues.

## **Water Quality Recommendations**

- All lake residents should practice best management on their lake properties, including keeping septic systems maintained in proper condition and pumped every three years, eliminating the use of lawn fertilizers, cleaning up pet wastes and not composting near the water.
- Reducing the amount of impervious surface around the lake and management of stormwater runoff will also help maintain water quality.
- Residents should become involved in the Citizen Lake Water Monitoring Program, which includes water quality monitoring, invasive species monitoring and Clean Boats, Clean Waters.

- Lake residents should protect and restore natural shoreline around Arkdale Lake. The lower frequency and density of the most sensitive plant species in the disturbed shoreline areas is evidence that shore disturbance is impacting the aquatic plant community of the lake.

### **Aquatic Plant Recommendations**

- All lake users should protect the aquatic plant community in Arkdale Lake by assisting in developing and implementing an integrated aquatic plant management plan that uses various methods of control..
- The Arkdale Lake Association should maintain exotic species signs at the boat landings and contact DNR if the signs are missing or damaged.
- The Arkdale Lake Association should continue monitoring and control of Eurasian Watermilfoil maintain the most effective methods and modify if necessary. Residents should hand-pull scattered plants.
- A milfoil weevil survey should be conducted on Arkdale Lake in order to evaluate milfoil weevil availability for assistance in controlling the Eurasian Watermilfoil.
- If weevils are found, shores with inadequate buffers need to restore the buffers to an adequate condition to provide winter habitat for the weevils, as well to assist in maintaining water quality.
- Lake residents should get involved in the county-sponsored Citizen Aquatic Invasive Species Monitoring Program. This will allow not only noting changes in the Eurasian Watermilfoil pattern, but also those for Curly-Leaf Pondweed, Rusty Crayfish and other invasives. Noting the presence and density of these plants early is the best way to take preventive action to keep them from becoming a bigger problem.

### **Critical Habitat Recommendations**

- Maintain current habitat for fish and wildlife.
- Leave fallen trees along shoreline & in water. Maintain snag/cavity trees for nesting.
- Seasonal protection of spawning habitat. No alteration of littoral zone except for WDNR-approved projects.
- Maintain the wildlife corridor.
- Maintain sedge meadow/deep marshes areas.
- Protect emergent vegetation.

- Seasonal control of exotics. If chemicals are used, they must be targeted for invasives, rather than broad spectrum.
- No bank grading or grading of adjacent land.
- Maintain aquatic vegetation in undisturbed condition for wildlife habitat, fish use and water quality protection.
- Minimize aquatic plant and shore plant removal to maximum 30' wide viewing/access corridor and navigation purposes. Leave as much vegetation as possible to protect water quality and habitat.
- No bank restoration unless erosion index scores moderate or high. If the index does score that high, bank restoration using bioengineering should be used, rather than rock riprap or retaining walls.
- Shore owners should use best management practices to protect water quality.
- Maintain lake no-wake designation.



**Swans on Arkdale Lake\***

*\*Courtesy of Doug Wellumson*